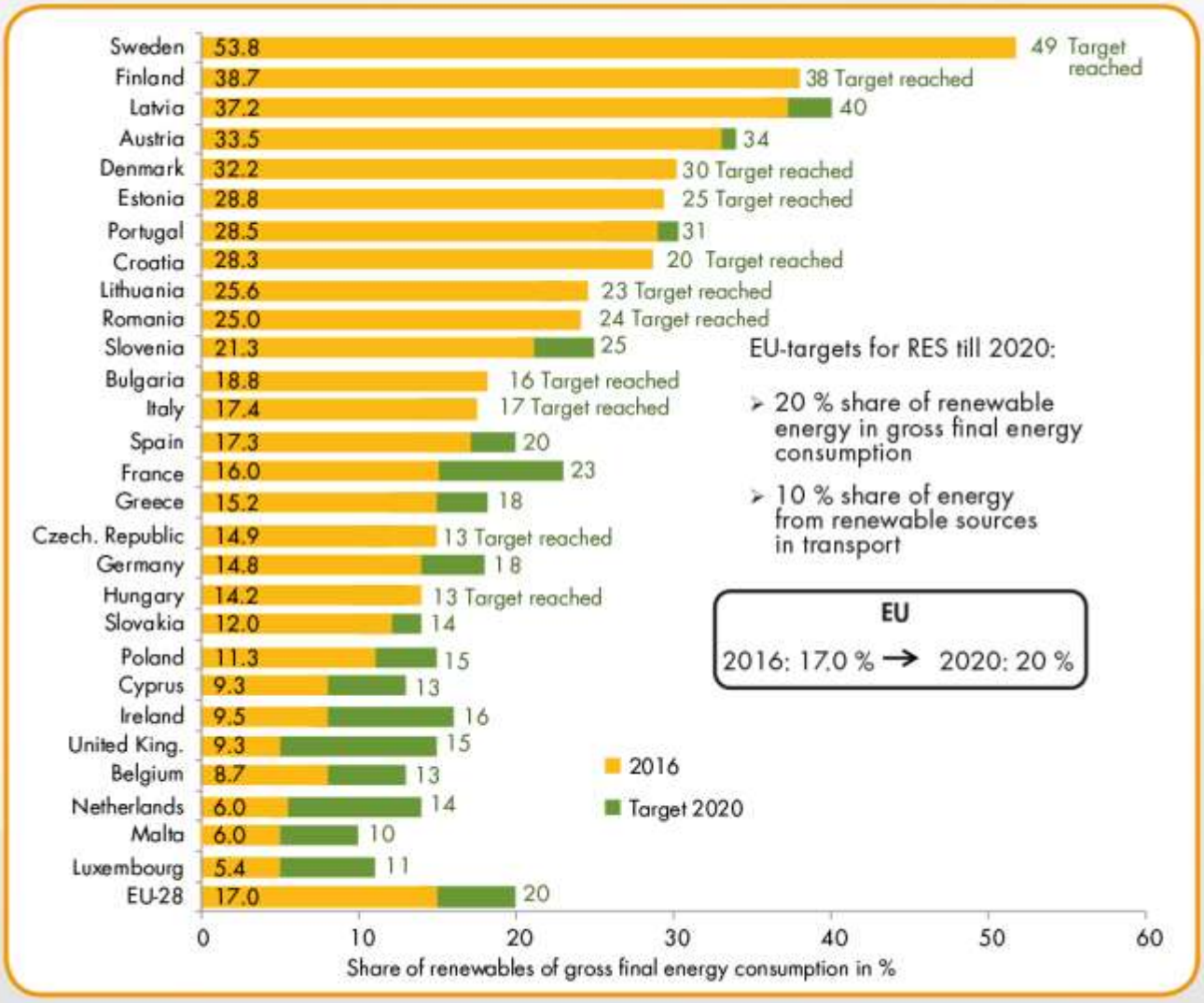
Trends on Coal Fired Power Plants in Europe

Dr. Thomas Eck, 30 November 2018, New Delhi

Agenda

1. Europe‘s Energy Targets / Consequences for Thermal Power Plants
2. VGB Performance Data Base KISSY – latest Availability Assessments
3. R&D Initiatives of VGB

1. EU's Targets for Renewables

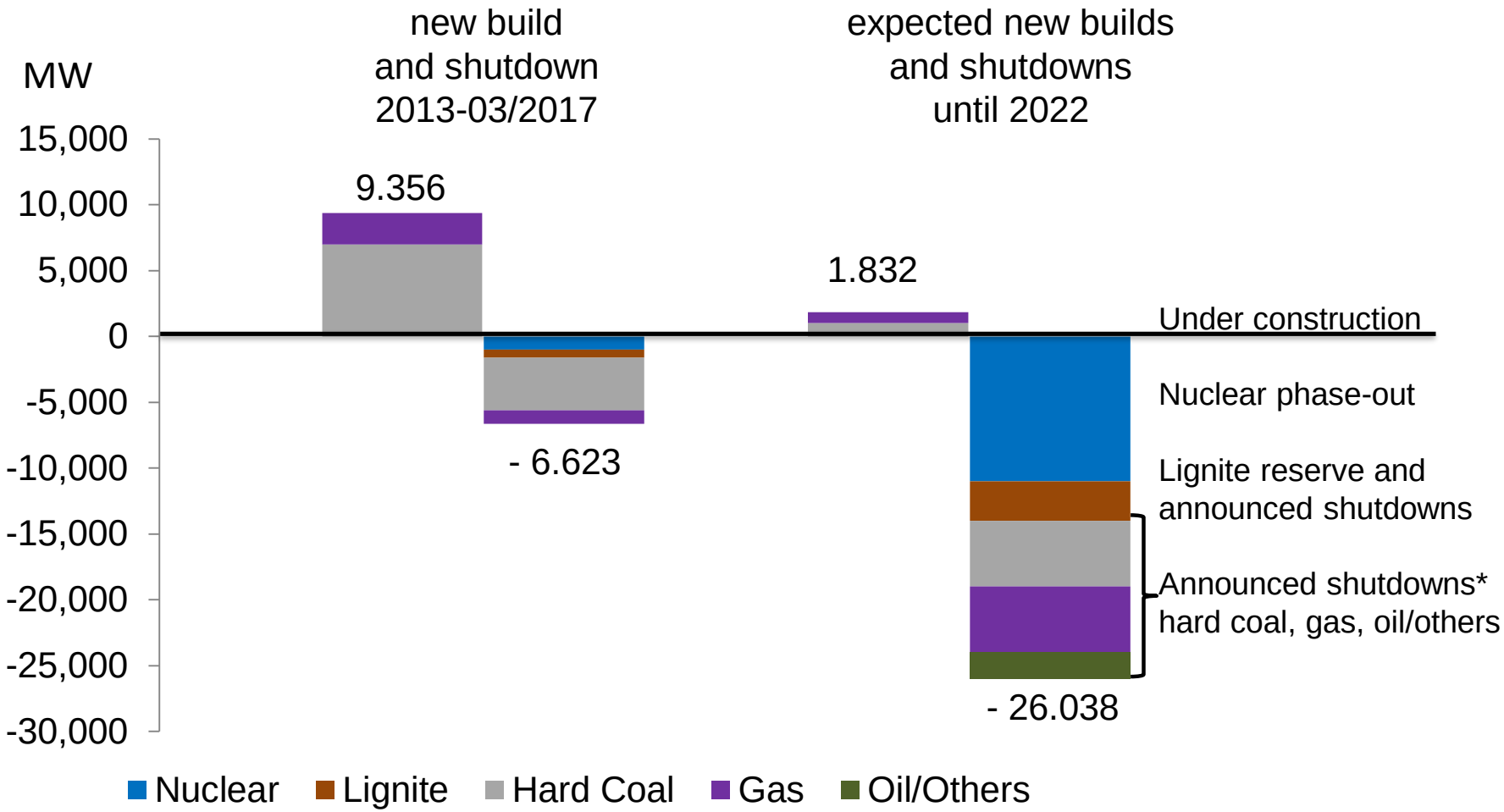


Source: Eurostat 2018 (data base: 2016)

1. Coal Phase out in Europe

Country	Capacity coal-fired power plant as of 2016	Status
UK	15 GW	Exit announced until 2025
France	~ 3 GW	Exit announced until 2022
Finland	~ 3 GW	Exit announced until 2030
Denmark	< 3 GW	Exit announced until 2025
Portugal	< 2 GW	Exit announced until 2025
Ireland	~ 1 GW	Exit announced until 2025
Austria	< 1 GW	Exit announced until 2025
Sweden	< 0,5 GW	Exit announced until 2025
Germany	~ 48 GW	Exit from coal or shut down under discussion
Spain	~ 10 GW	Exit from coal or shut down under discussion
Italy	~ 8 GW	Exit from coal or shut down under discussion
The Netherlands	< 6 GW	Exit from coal or shut down under discussion

1. Capacity Development of Nuclear and Thermal Power Plants in Germany



* Subject to decision of Bundesnetzagentur on system relevance, Source: BNetzA

A significant shutdown of dispatchable conventional generation will not be covered by capacity additions except on basis of variable renewables (mainly wind and PV). This drives storage solutions such as Power-to-X.

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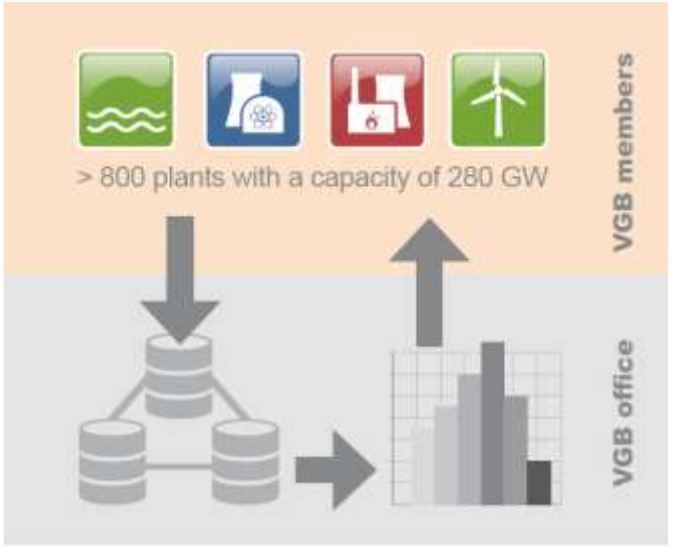
Target: Optimization of power plants in a competitive and harsh market environment

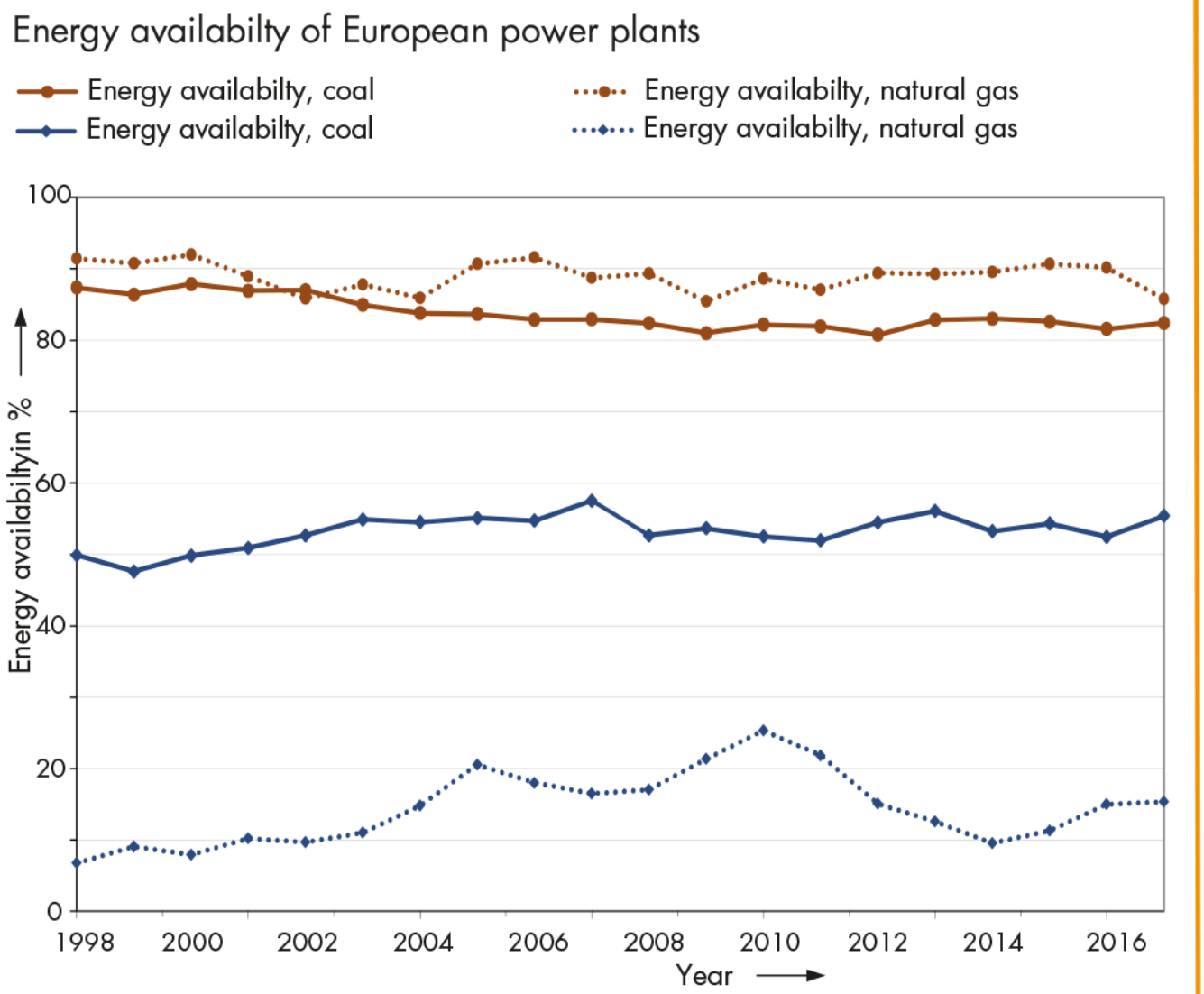


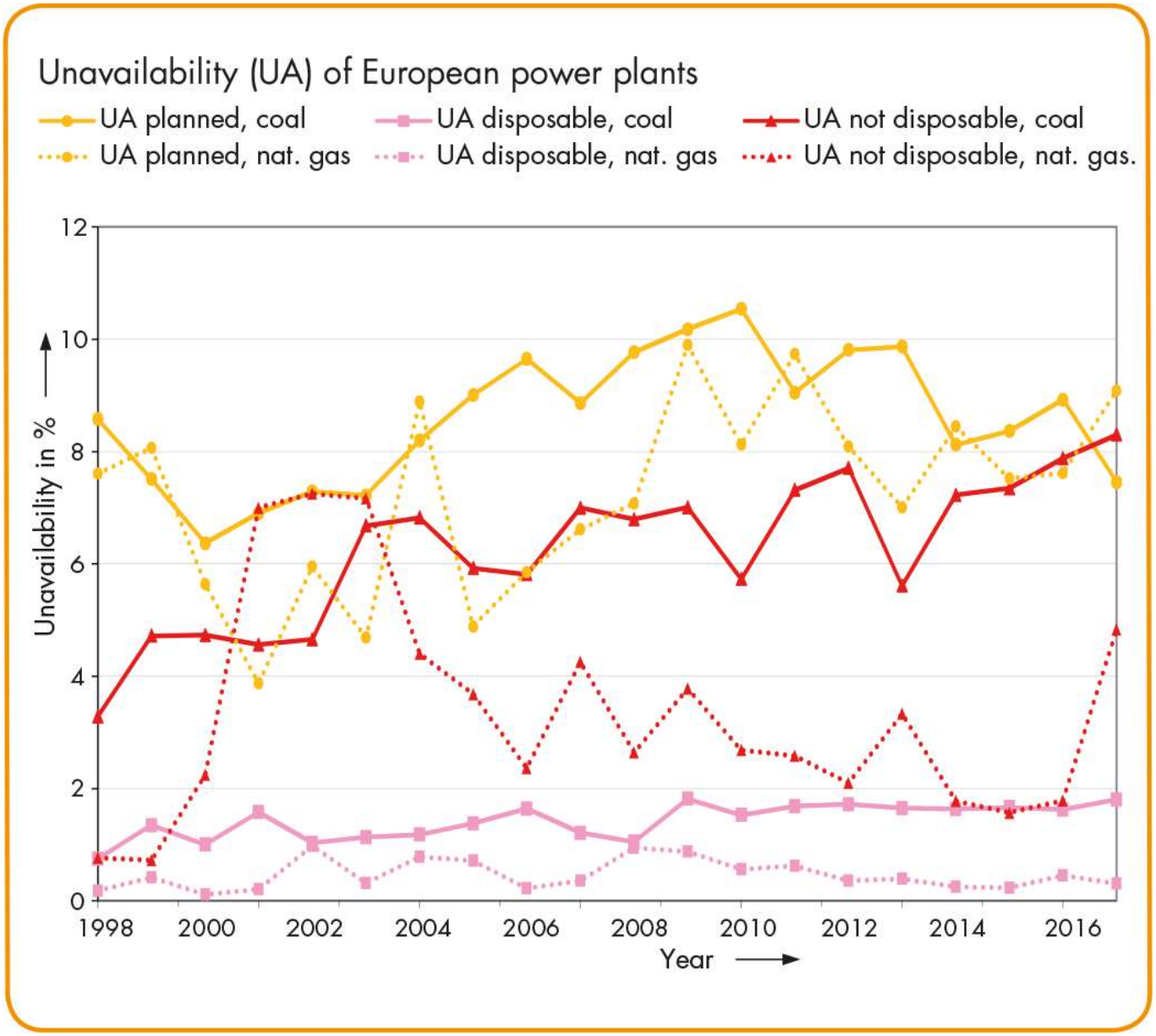
1. Collection of **availability data** and determination of **performance indicators**,
2. Recording of **unavailability incidents** for individual power plant components,
3. Analysis of **reliability indicators** of components,
4. **Benchmarking** of a power plant with a peer group of similar plants,
5. Definition basis: VGB-Standard „Technical and commercial Indicators of Power Plants“ (**VGB-S002-03 2016**)
   free download from www.vgb.org

Products:

- annual VGB report TW 103 V „Availability of Power Plants“,
- individual analysis,
- Special reports, e.g. VGB/WEC availability report for WEC Istanbul Summit 2016

KISSY is the leading performance database for power plants and renewable-based generating facilities and delivers strategic important KPIs based on internationally recognised definitions and methods for more than 40 years.

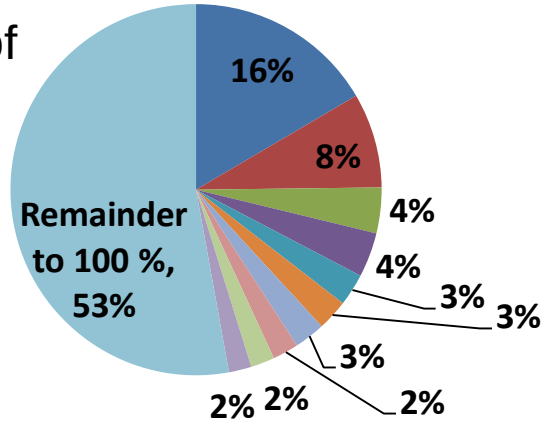

Energy availabilty of European power plants
Energy availabilty, coal
Energy availabilty, coal
Energy availabilty, natural gas
Energy availabilty, natural gas
100
80
60
40
20
0
Energy availabiltyin %
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year


Unavailability (UA) of European power plants
UA planned, coal
UA disposable, coal
UA not disposable, coal
UA planned, nat. gas
UA disposable, nat. gas
UA not disposable, nat. gas.
Unavailability in %
0
2
4
6
8
10
12
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
Year

POWERTECH

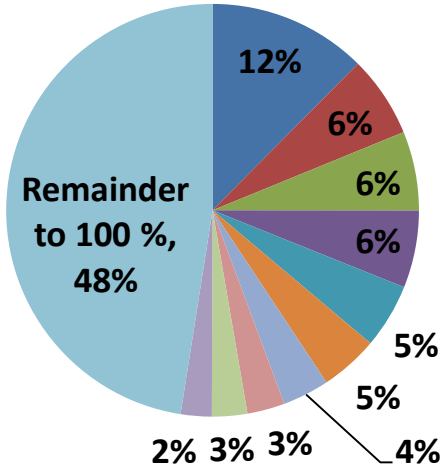
Collective: 30 units, Germany, hard coal, > 200 MW, 2005 - 2015

Number of incidents



- Pulverizing system (incl. classifier)
- Evaporator system
- Feeder system
- Feedwater conveyance
- HP superheater system
- Bunker, feeder and pulverizing system
- Pressure system, feedwater and steam sections
- Support structure, enclosure, steam generator interior
- without Description (e.g. event after revision)
- Reheat system

Lost MWh



- Evaporator system
- Generator, complete, incl. stator, rotor and all integral cooling equipment
- LP turbine
- HP superheater system
- Pressure system, feedwater and steam sections
- Reheat system

The majority of incidents is caused by coal handling devices and the evaporator. Lost generation is mainly caused by systems with extensive repairs (evaporator) and/or long-lead items (turbine, generator).

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Wear investigation model for thermal power plants at supply of control power

VGB-Lenkungskreis
zum Forschungsprojekt
VGB 632

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Lehrstuhl für Technische Thermodynamik
A. Berndt, Prof. H. Weber
Institut für Elektrische Energietechnik
P. Mutschler, Prof. M. Sander
Lehrstuhl für Strukturmechanik

S. Beck, Dr.-Ing. K. Helbig
Lifetime, Condition Assessment
& Monitoring
ALSTOM Power GmbH

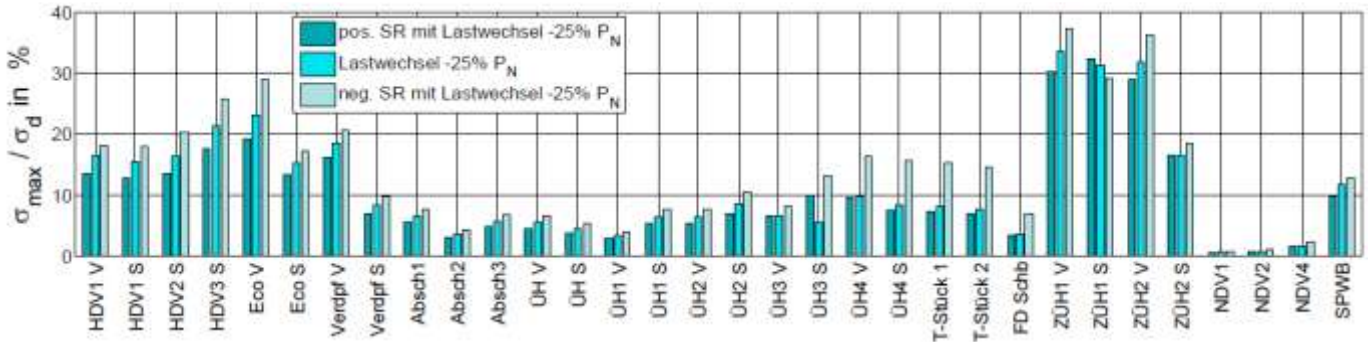
Scope:

- Determination of component stresses on the basis of pressure and temperature gradients from the simulation calculations
- transient thermodynamic power plant models for 3 reference power plants:
  - *Lignite-fired power plant Jänschwalde*
  - *Coal-fired power plant Rostock*
  - *Combined-cycle plant Mainz-Wiesbaden*

  Inclusive emulation of original control technology for showing of primary and secondary control processes
- Damage mechanism, stress and lifetime consumption
- Wear of control valves at primary control

Main results

- Rising number of startups and shutdowns, load gradients and load change -> Operation beyond original design
- **Impact of primary and secondary control regarding fatigue limit according to DIN EN 12952 for defined components in the water-steam-cycle uncritical** (approach: investigation of components free of cracks)



- Continous primary control (by throttling) leads to reduced operation duration of turbine control valve by at least 20%
- Small and frequent load changes through primary and secondary control lead to an increased crack growth failure at single components

Thank you
for your interest!

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